# Mumbai University

## Question Paper

# [IDOL – REVISED COURSE]
# (DECEMBER – 2017)

# PAPER - II

# DIGITAL

## SIGNALS AND SYSTEMS

**Time:** 3 Hours
**Total Marks:** 100

**N.B.:** **(1)** *All Question are Compulsory.*
  **(2)** *Make Suitable Assumptions Wherever Necessary And State The Assumptions Made.*
  **(3)** *Answer To The Same Question Must Be Written Together.*
  **(4)** *Number To The Right Indicates Marks.*
  **(5)** *Draw Neat Labeled Diagrams Wherever Necessary.*
  **(6)** *Use of Non – Programmable Calculator is allowed.*

**Q.1 ATTEMPT ANY TWO QUESTIONS: (10 MARKS)**

**(A)** What are the advantages of Digital Signal Processing (DSP) over Analog Signal Processing (ASP)? **(5)**
**(B)** What is Region of Convergence? **(5)**
**(C)** With reference to z-Transform, State and the Initial and Final Value Theorem. **(5)**
**(D)** Define the terms: **(5)**
  **(i)** *Linearity*
  **(ii)** *Causality*

**Q.2 ATTEMPT ANY THREE QUESTIONS: (15 MARKS)**

**(A)** Define & give the Graphical representation of Unit step and Unit Impulse. **(5)**
**(B)** Discuss the classification of systems. **(5)**
**(C)** Draw and explain the block diagram of an Analog-To-Digital Converter. **(5)**
**(D)** What is meant by Sampling? State Sampling Theorem. **(5)**
**(E)** What is meant by Quantisation and Encoding? **(5)**
**(F)** Write a note on Dirichlet's Conditions. **(5)**

**Q.3 ATTEMPT ANY THREE QUESTIONS: (15 MARKS)**

**(A)** Find the Laplace Transform of Cosine Function. **(5)**
**(B)** Find Laplace transform of the periodic sawtooth waveform with period of one cycle T. **(5)**
**(C)** State any five properties of Laplace transform. **(5)**
**(D)** Define the network transfer function & explain how to obtain output impulse & step response using transfer function. **(5)**
**(E)** State and explain Laplace Transform and its inverse transform. **(5)**
**(F)** Obtain Laplace transform for step and Impulse Responses of Series R-L Circuit. **(5)**

**Q.4 ATTEMPT ANY THREE QUESTIONS: (15 MARKS)**

**(A)** Define z-Transform. Explain the use of z-Transform. **(5)**
**(B)** Compare the properties of two-sided z-transform with those of one-sided z-Transform. **(5)**
**(C)** What is the condition for z-Transform to exist? **(5)**
**(D)** Obtain the Z-Transform of $x(n) = n^2 u(n)$. **(5)**
**(E)** How is z-Transform obtained from Laplace Transform? **(5)**
**(F)** State and explain the properties of z-Transform. **(5)**

**Q.5 ATTEMPT ANY THREE QUESTIONS: (15 MARKS)**

**(A)** Simple problems to check the Linearity and Causality of the signals. **(5)**
**(B)** Explain briefly the Paley-Wiener Criterion. **(5)**
**(C)** Explain stability in Linear Time Invariant System. What is the condiction for a System to be BIBO Stable? **(5)**
**(D)** What is Convolution? What are the properties of Convolution? **(5)**
**(E)** What is Frequency Response? What are the properties of frequency response? **(5)**
**(F)** Check whether the system $F[x(n)] = n[x(n)]^2$ is Linear and Time-Variant. **(5)**

**[TURN OVER]**

**Q.6  ATTEMPT ANY THREE QUESTIONS: (15 MARKS)**

**(A)** Explain any 5 properties of DFT. **(5)**

**(B)** State and explain the properties of Discrete Fourier Series. **(5)**

**(C)** Define Discrete Fourier Transform (DFT) for a sequence x(n) **(5)**

**(D)** What are the methods used to perform Fast Convolution. Explain any one method giving all the steps involved to perform Fast Convolution. **(5)**

**(E)** Compute Linear and Circular Periodic Convolutions of the sequence x1(n)= {1,1,2,2} and x2(n)= {1,2,3,4} using DFT. **(5)**

**(F)** State the relationship between DFT and z-Transform. **(5)**

**Q.7  ATTEMPT ANY THREE QUESTIONS: (15 MARKS)**

**(A)** Explain the effects of Windowing. Define Rectangular and Hamming Window Functions. **(5)**

**(B)** Describe the Inverse Chebyshev Filters. **(5)**

**(C)** Obtain the system functions of normalized Butterworth filters for order N = 1 & 2. **(5)**

**(D)** State the advantages of Digital Filters. **(5)**

**(E)** Describe Elliptical Filters in detail. **(5)**

**(F)** Explain the procedure for Designing an FIR Filter using Kaiser Window. **(5)**